

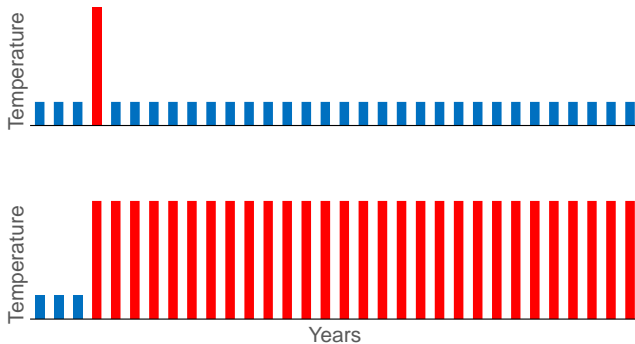
The Scope for Climate Adaptation: Evidence from Irrigated Agriculture in California

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Costs of climate change depend on how much we can adapt



- Long-run impacts hard to estimate well
- Do they differ from short-run impacts?
- How much adaptation is possible?

This paper

I estimate the scope for adaptation to surface water scarcity

- By directly comparing the short- and long- run effects.
- In a setting well-suited to causal inference: irrigated agriculture in California.

Institutional features allow me to:

1. Credibly identify long-run effects of water availability.
2. Measure short-run effects in the same sample.

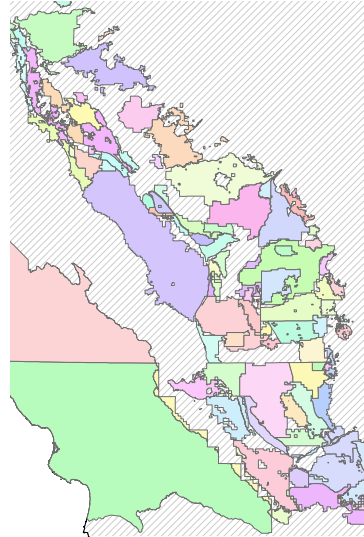
Difference between these effects reveals the extent of adaptation.

Long-run effects via spatial discontinuities

- Agriculture in California is irrigated, not rainfed
 - Precipitation matters through surface water supplies
 - Irrigation districts receive & deliver water to farms.
- Water availability varies:
 - From year to year (by weather conditions)
 - Sharply & persistently in space (by irrigation district)

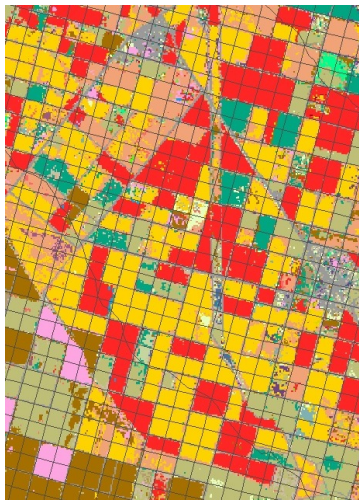
Short-run effects: Compare same farm across years.

Long-run effects: Compare farms across boundaries.

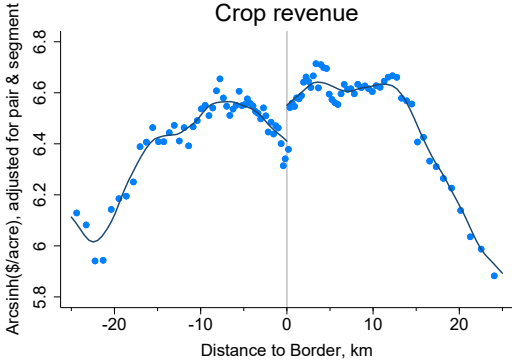
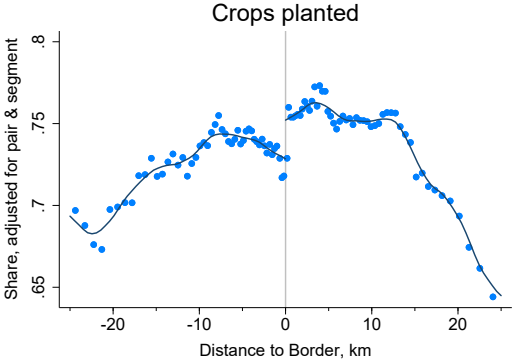


Remote sensing gives 3 billion data points

- **Land use data:** Cropland Data Layer (USDA)
 - Crop grown at every pixel in a 30m grid.
 - All farmland in California, 2007-2018.
- **Crop revenue** calculated as a function of land use.
 - Average revenue per acre by crop/county/year.
 - Captures only effects through crop switching.

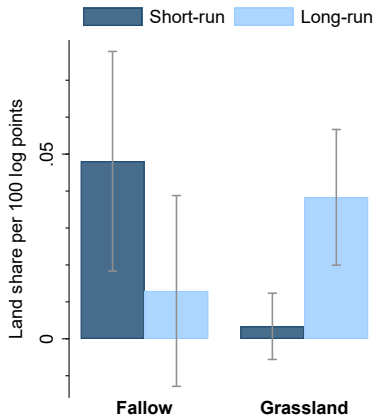


2. Long-run scarcity also reduces crop area & revenue

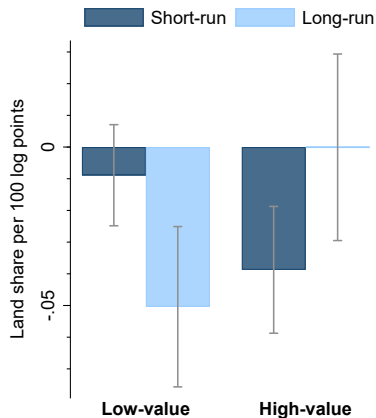


3. Some evidence of adaptation in the long run

Land is retired instead of held fallow.



Farmers invest in higher-value crops.



4. Adaptation is limited, as measured by crop revenue

	Elasticity of revenue	Percent
Short-run	0.36	100%
Long-run	0.31	85%
Adaptation	0.06	15%

- Caveats:
 - May omit some channels of adaptation.
 - Revenue is not welfare.

Climate change is likely to reduce agricultural output

Future impacts of climate change?

- Here, short-run effects are not a bad guide to long-run effects
- Surface water supplies projected to decline in California
- Expect land-use shifts and output losses.